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DeAngelis

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[54] **PRINTING METHOD AND APPARATUS**

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Related U.S. Application Data

[60] Division of Ser. No. 168,752, Dec. 16, 1993, which is a continuation-in-part of Ser. No. 902,840, Jun. 23, 1992, Pat. No. 5,320,334.

[51] **Int. Cl.**[6] **B41F 13/58**; B42D 1/00

[52] **U.S. Cl.** **270/7**; 270/9; 270/10; 270/18; 270/20.1; 283/56; 281/15.1

[58] **Field of Search** 270/21.1, 37, 1.01, 270/4, 5.01, 6, 7, 8, 9, 10, 18, 19, 20.1, 38, 43, 44, 45, 51; 283/56; 281/15.1

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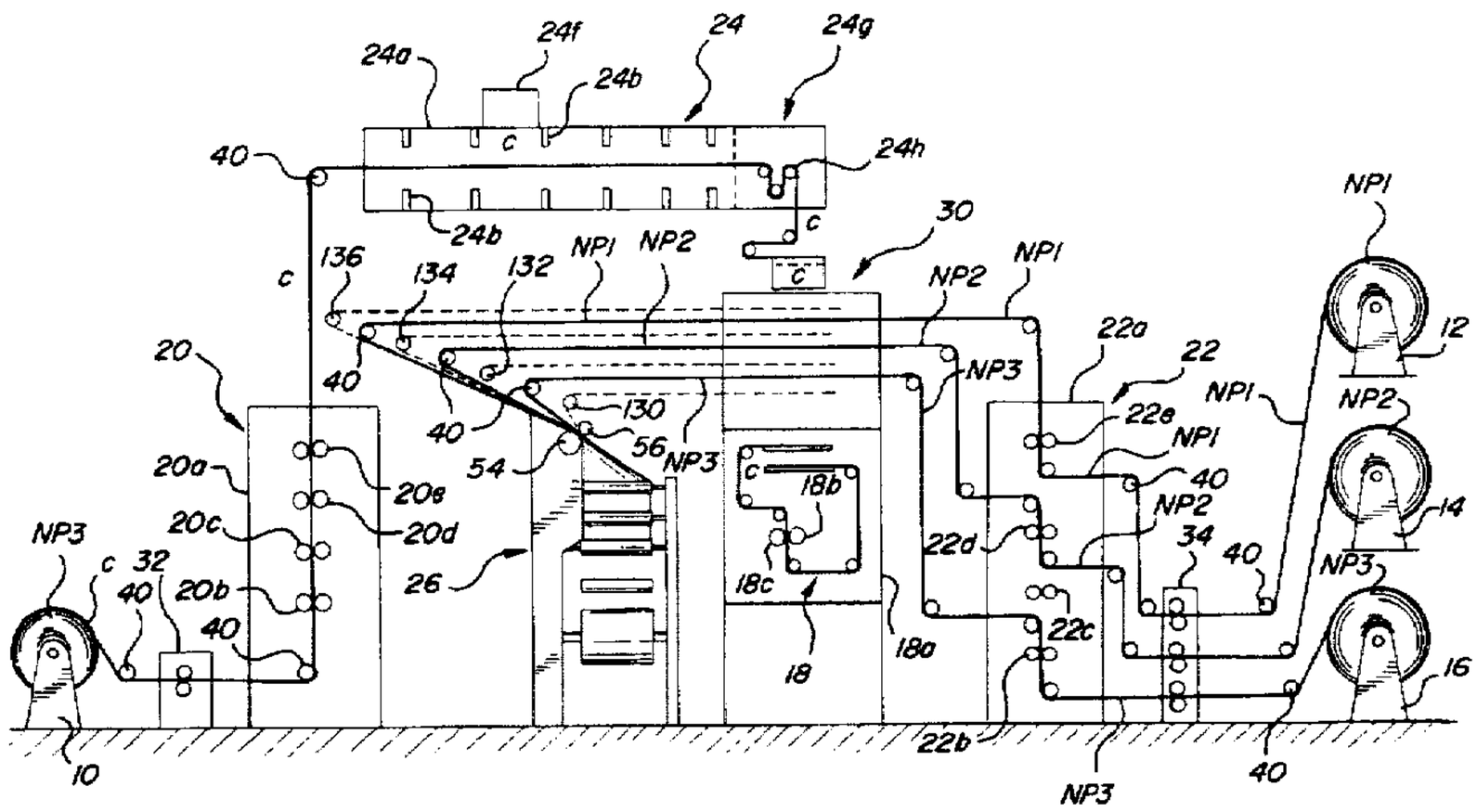
Primary Examiner—Hoang Nguyen

Attorney, Agent, or Firm—Gifford, Krass, Groh, Sprinkle, Patmore, Anderson & Citkowski, P.C.

[57] **ABSTRACT**

A method and apparatus for forming books comprising pages of coated paper interspersed with pages of newsprint paper. The book is formed by providing a moving web of coated paper, providing a plurality of moving webs of newsprint paper, printing the moving web of coated paper with inks of a plurality of colors including printing within identified coupon areas, selectively perforating the moving web of coated paper around the printed coupon areas, subjecting the moving web of coated paper to a heatset operation to set the inks on the web, printing the moving webs of newsprint paper with at least one color ink, and associating the moving webs of coated paper and newsprint paper in a pasting, folding, and cutting operation to form a plurality of books each comprising a plurality of pages of coated paper interspersed with a plurality of pages of newsprint paper and adhesively bound together along one longitudinal edge of the book and each including detachable coupons on at least some of the coated paper pages. An interleaver is also provided which enables the coated web to be selectively inserted with respect to the several moving webs of newsprint paper to selectively vary the relative positioning of the coated web and the newsprint webs prior to undergoing the pasting, folding and cutting operation.

19 Claims, 7 Drawing Sheets



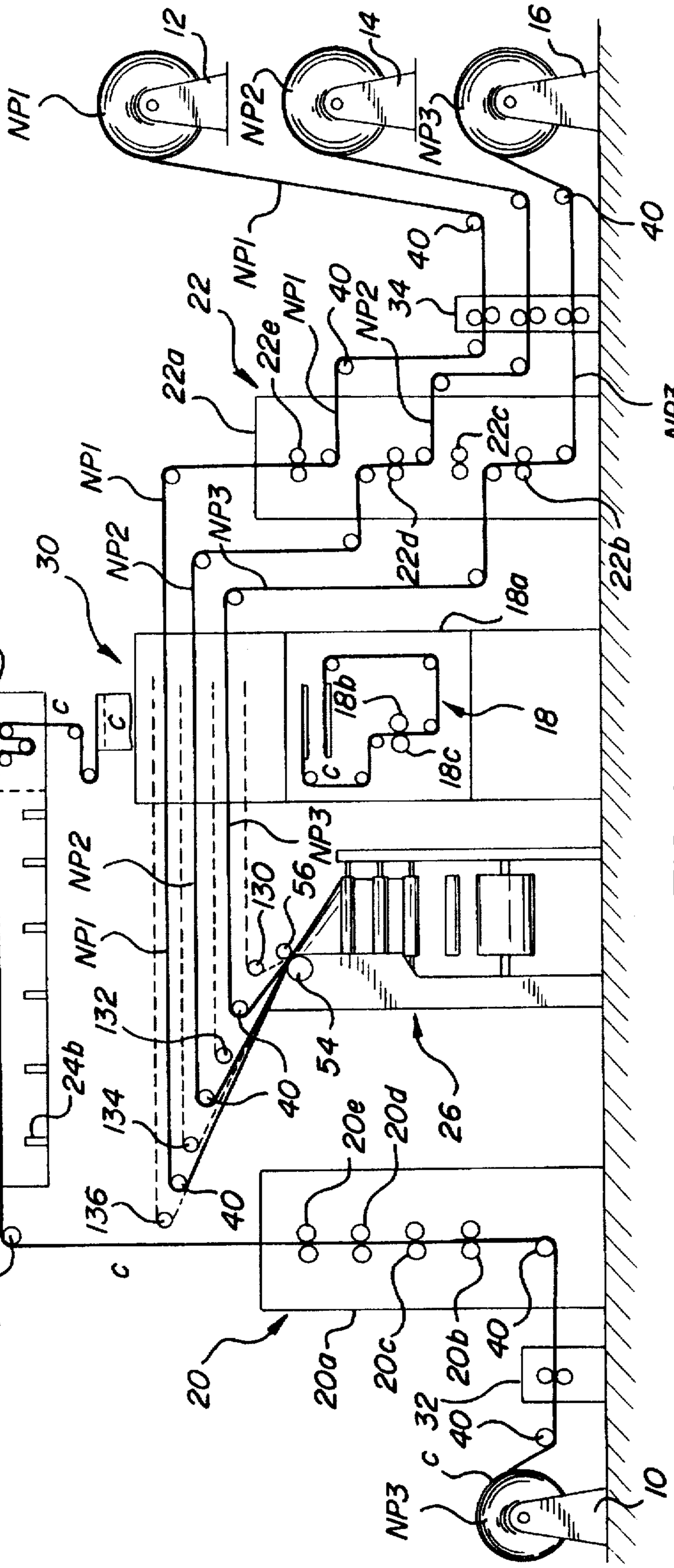

12
14
16
NP1
NP2
NP3
40
22
22a
22e
34
30
180
22b
22c
22d
18
18b
18c
24
24h
24g
24f
24b
24a
130
56
132
54
134
26
136
20
20a
20c
20b
32
10

FIG-1

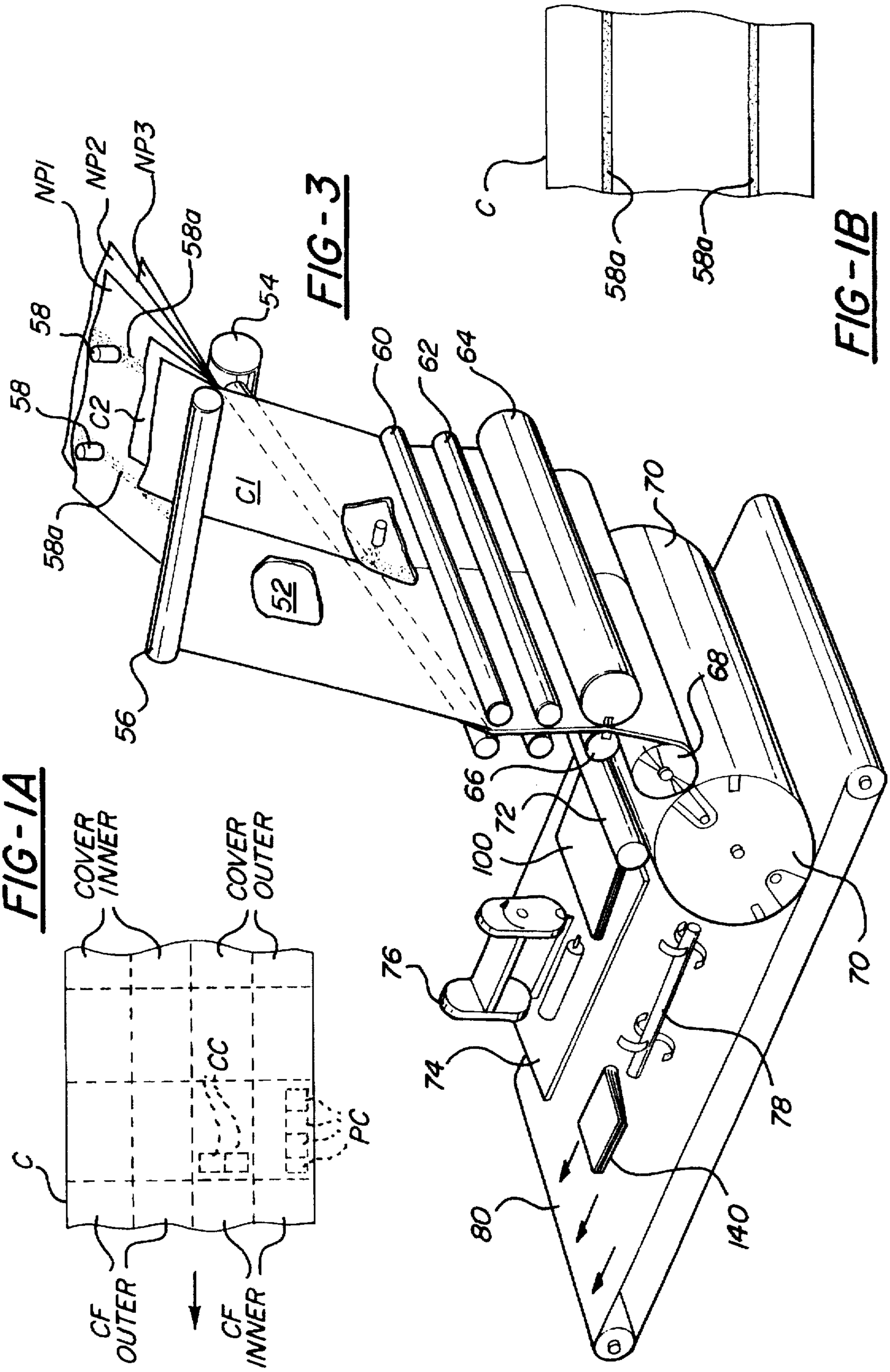


FIG-3

FIG-1B

FIG-1A

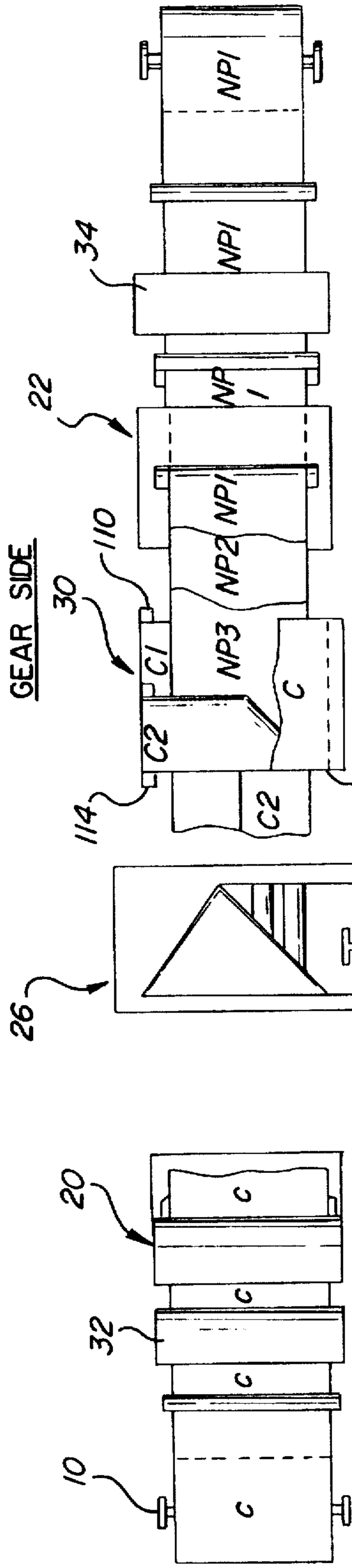

NP1
34
NP1
22
NP1
NP2
NP1
110
30
C1
NP3
C
C2
C2
114
40
GEAR SIDE
OPERATOR SIDE
20
c
c
c
32
10
26
140
90
94
28
92
96
98

FIG-2

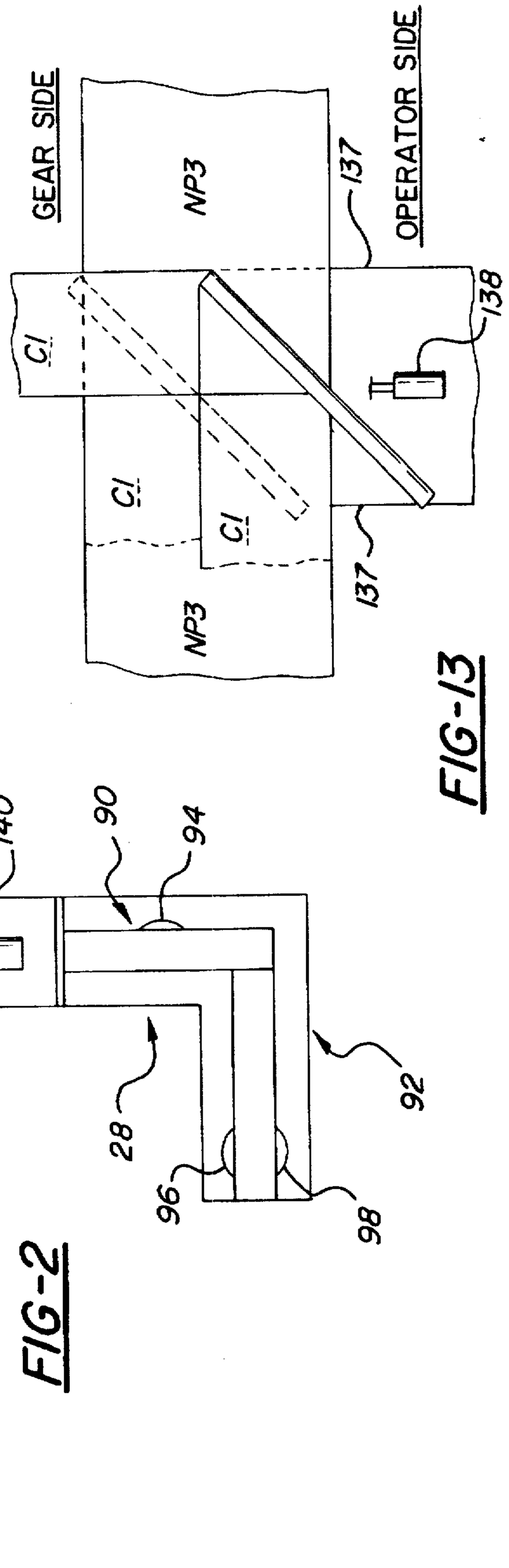

GEAR SIDE
OPERATOR SIDE
NP3
137
138
C1
C1
C1
NP3
137

FIG-13

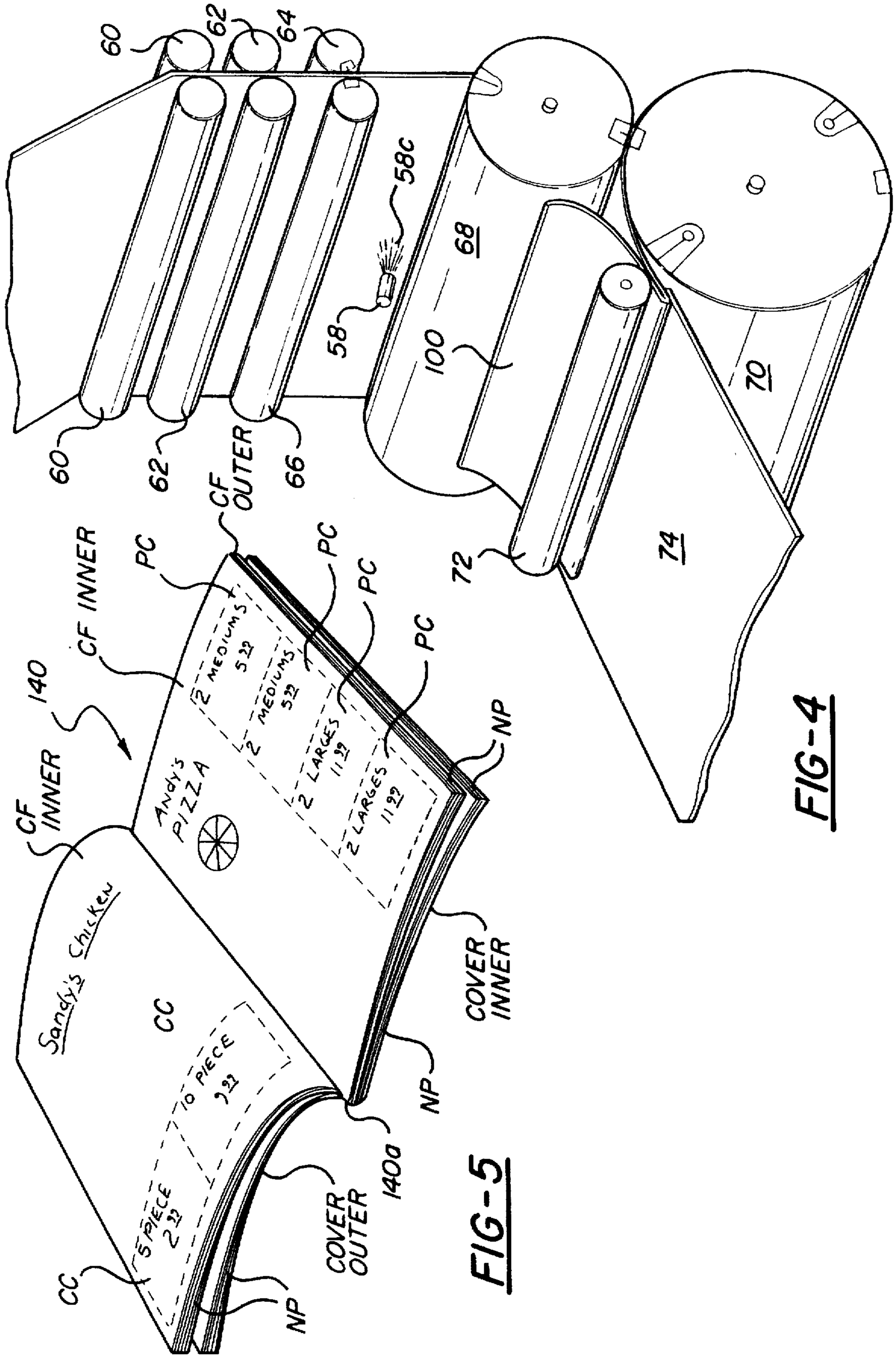

60
62
64
58c
68
58
100
70
72
74
60
62
CF OUTER
66
CF INNER
PC
PC
PC
PC
NP
NP
140
CF INNER
Andy's PIZZA
2 MEDIUMS 5.22
2 MEDIUMS 5.22
2 LARGES 11.92
2 LARGES 11.92
Sandy's Chicken
CC
10 PIECE 7.21
5 PIECE 2.21
CC
NP
COVER OUTER
140a
COVER INNER

FIG-4

FIG-5

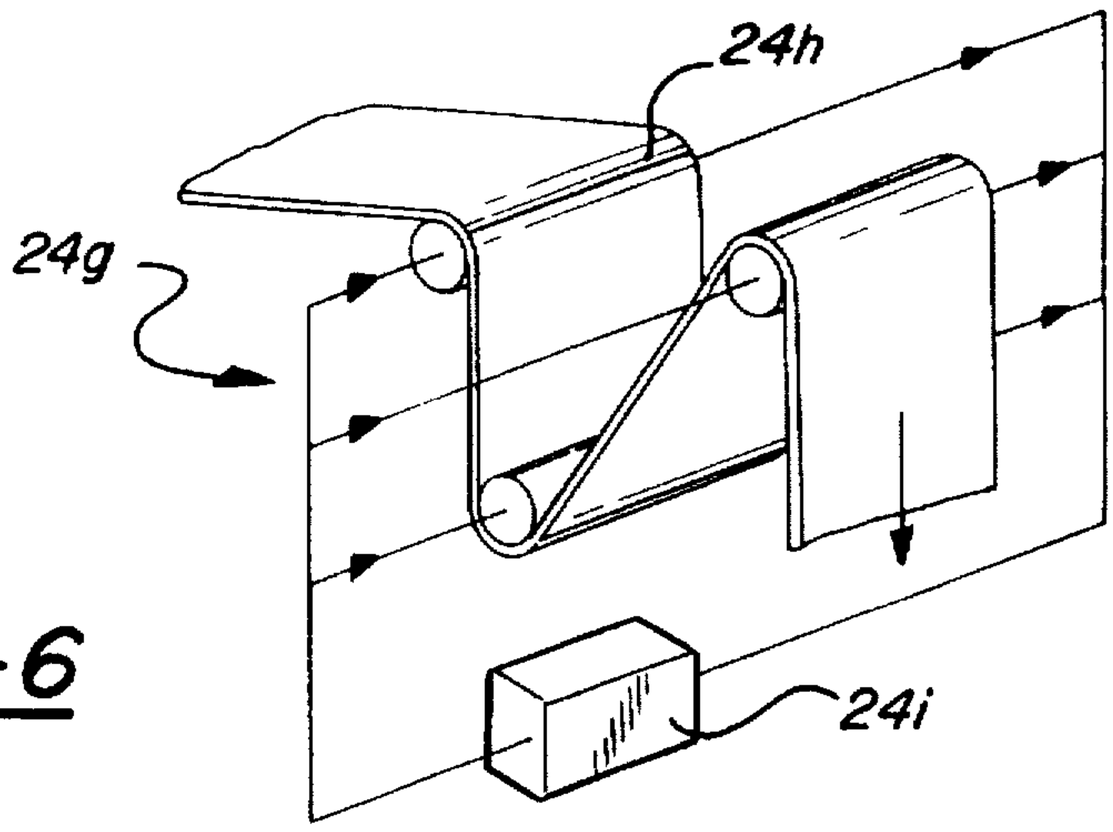

24h
24g
24i

FIG-6

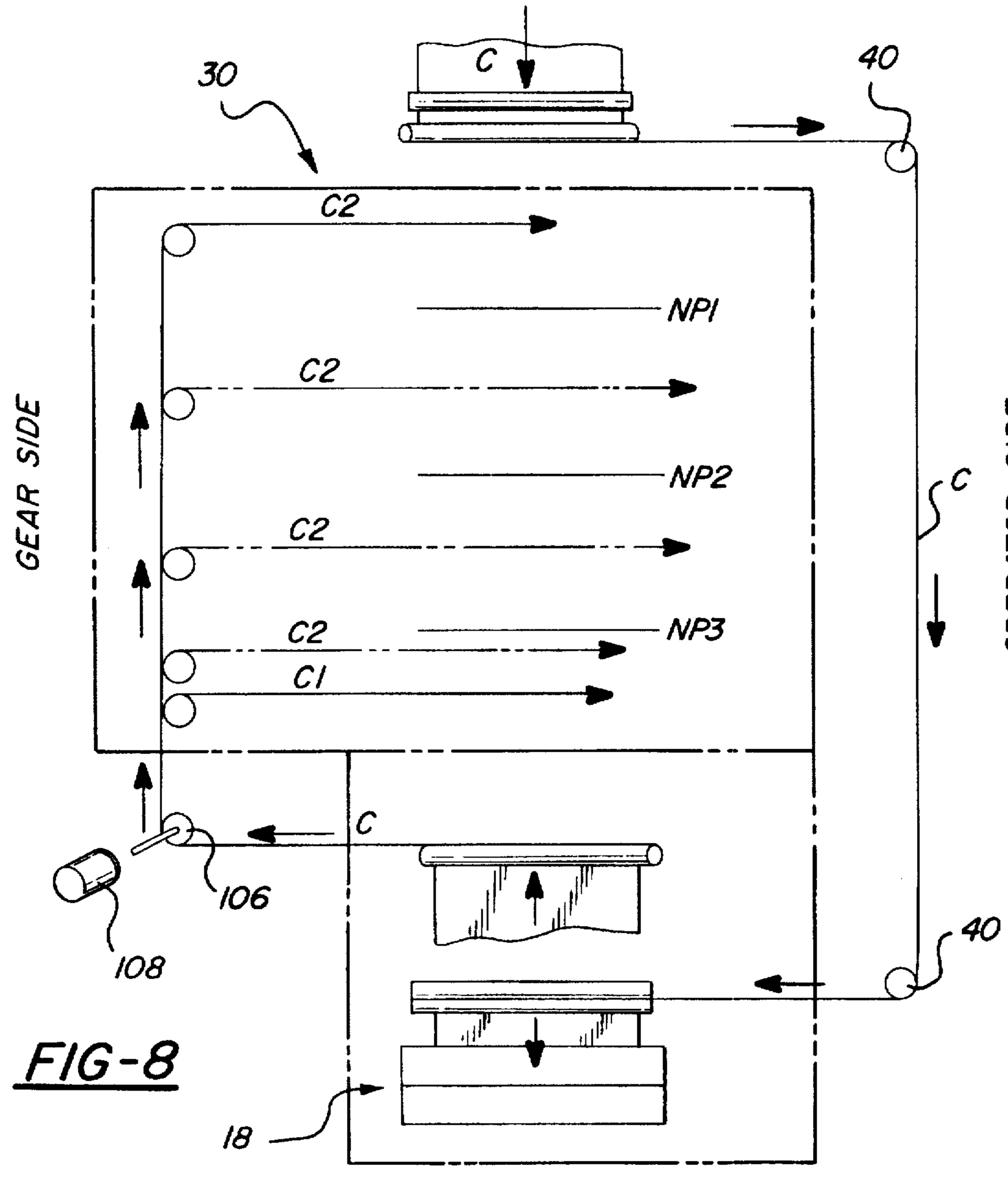

30
C
40
C2
NP1
C2
NP2
C2
NP3
C2
C1
GEAR SIDE
OPERATOR SIDE
C
C
106
108
40
18

FIG-8

FIG-7

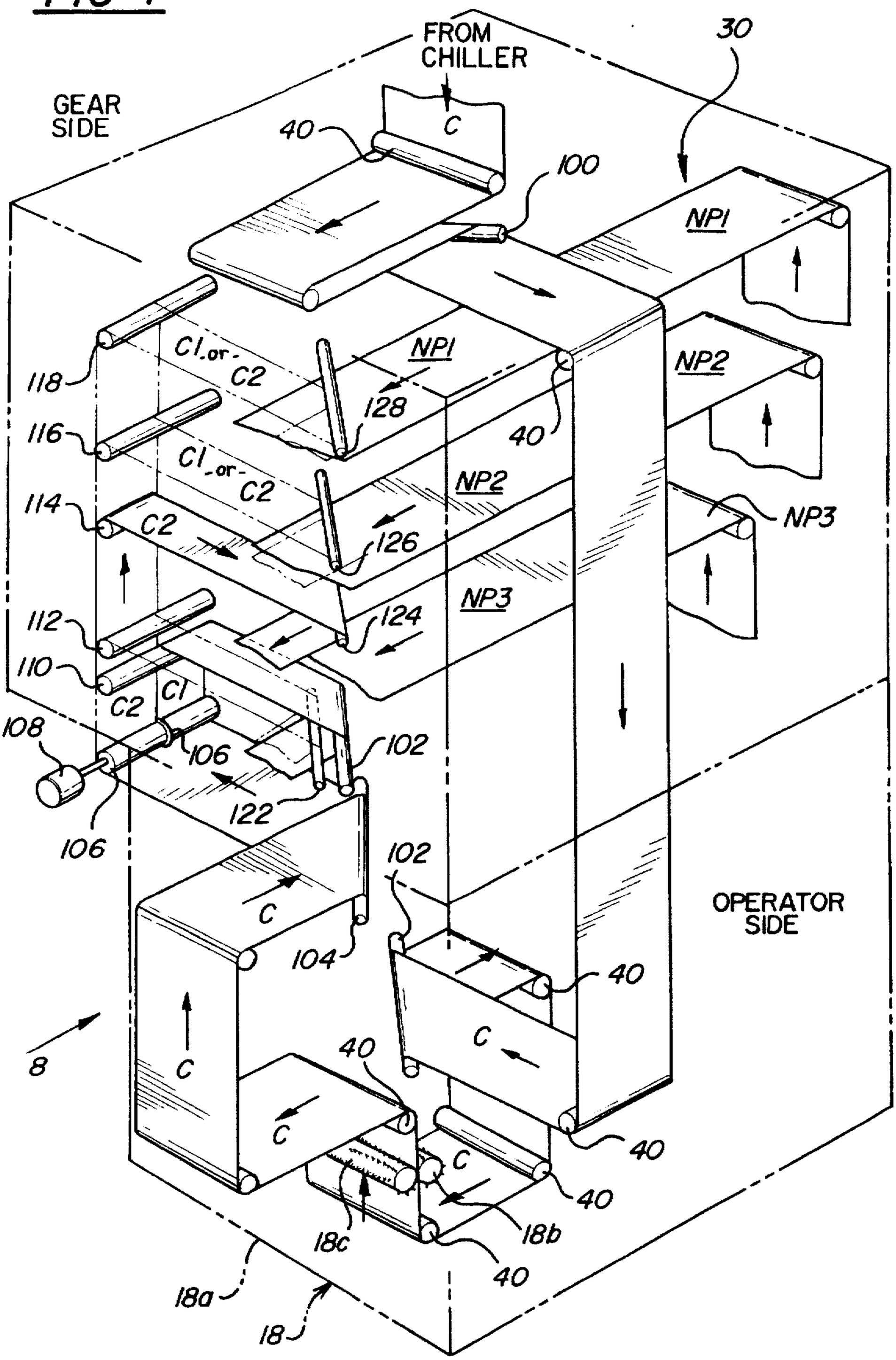

FROM CHILLER
30
GEAR SIDE
40
C
100
NP1
C1 or C2
118
NP1
128
NP2
116
C1 or C2
40
NP2
114
C2
126
NP3
NP3
112
124
110
C2
C1
108
106
102
122
106
102
C
104
OPERATOR SIDE
40
8
C
40
C
C
40
40
18b
18c
40
18a
18

FIG-9A

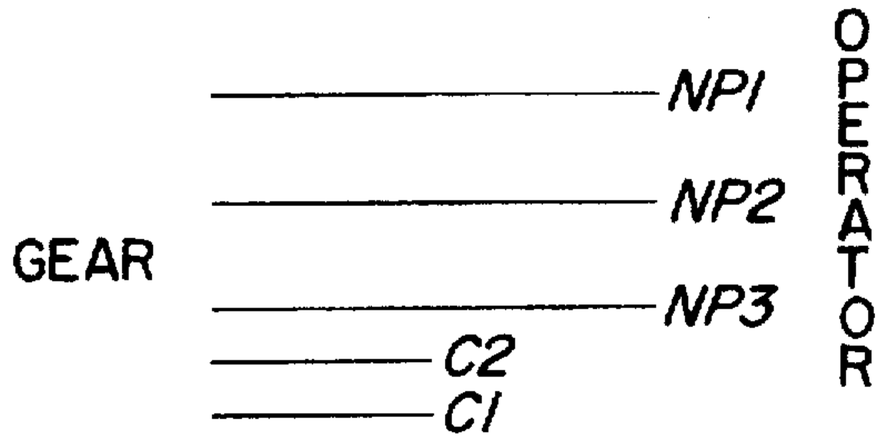


FIG-9B

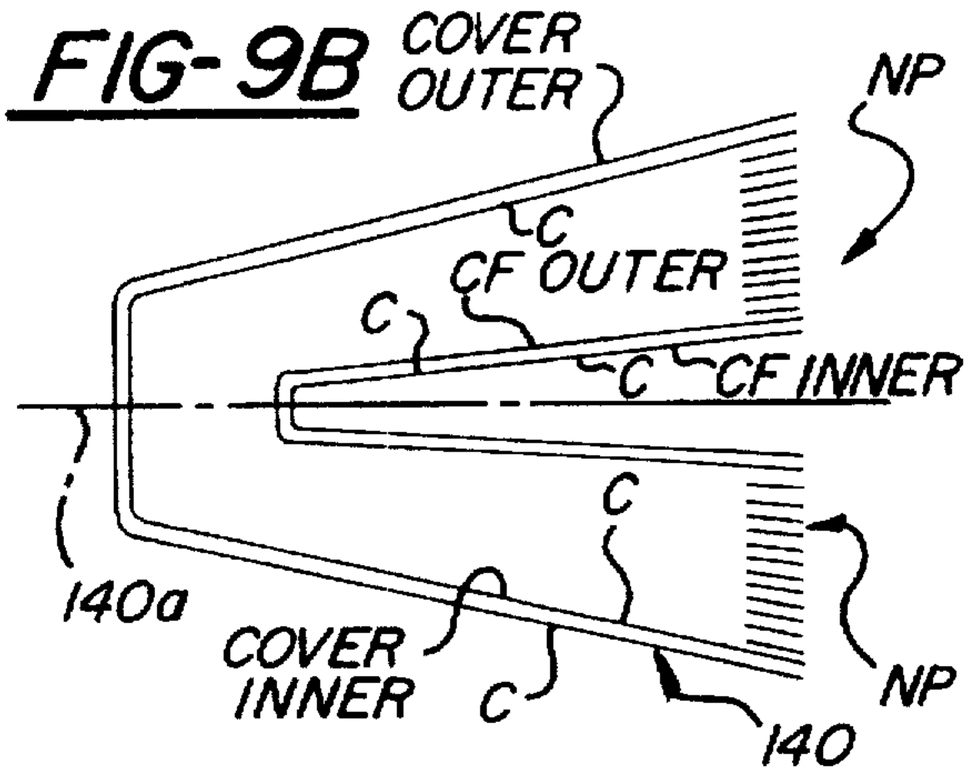


FIG-10A

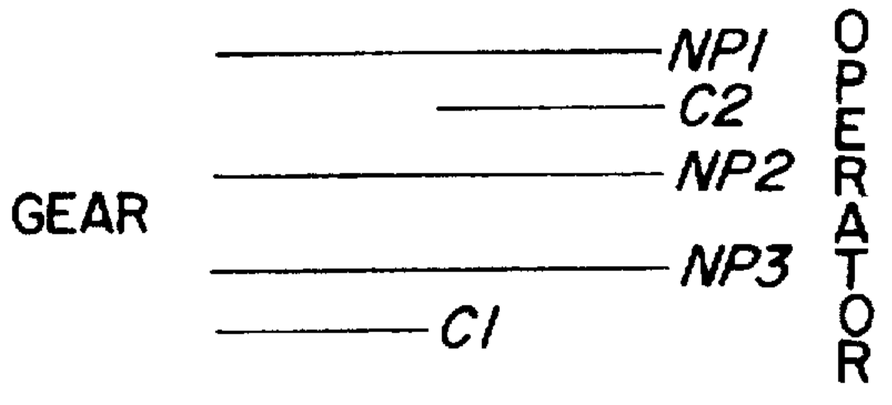
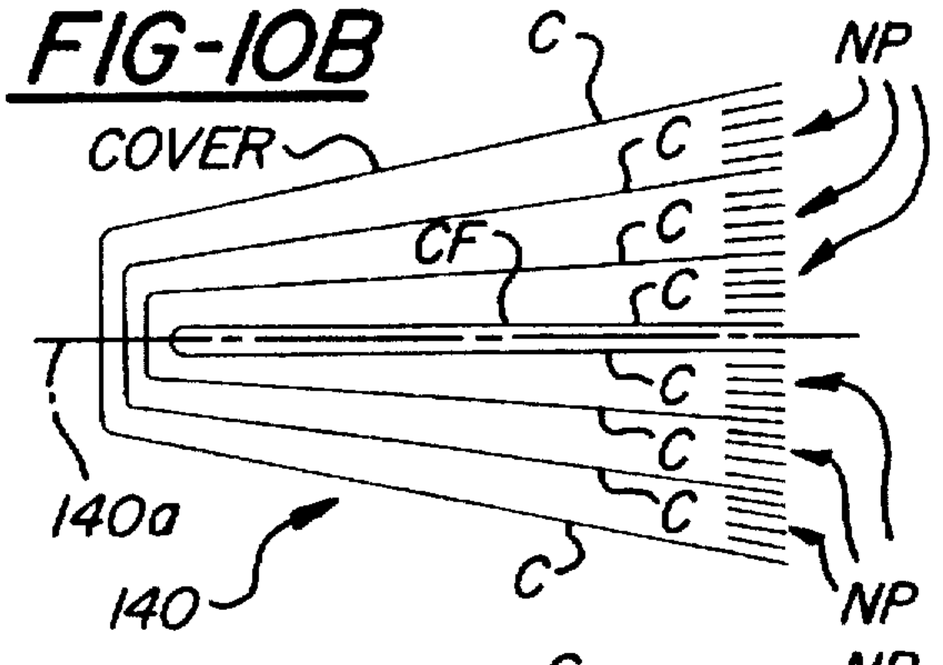


FIG-10B



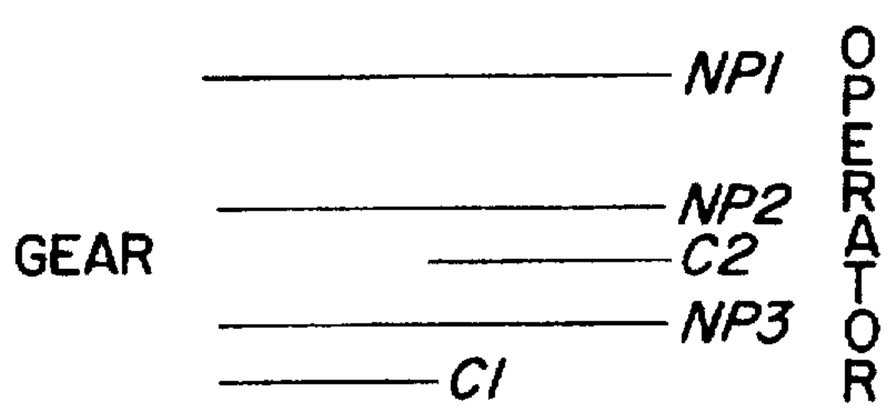


FIG-11A

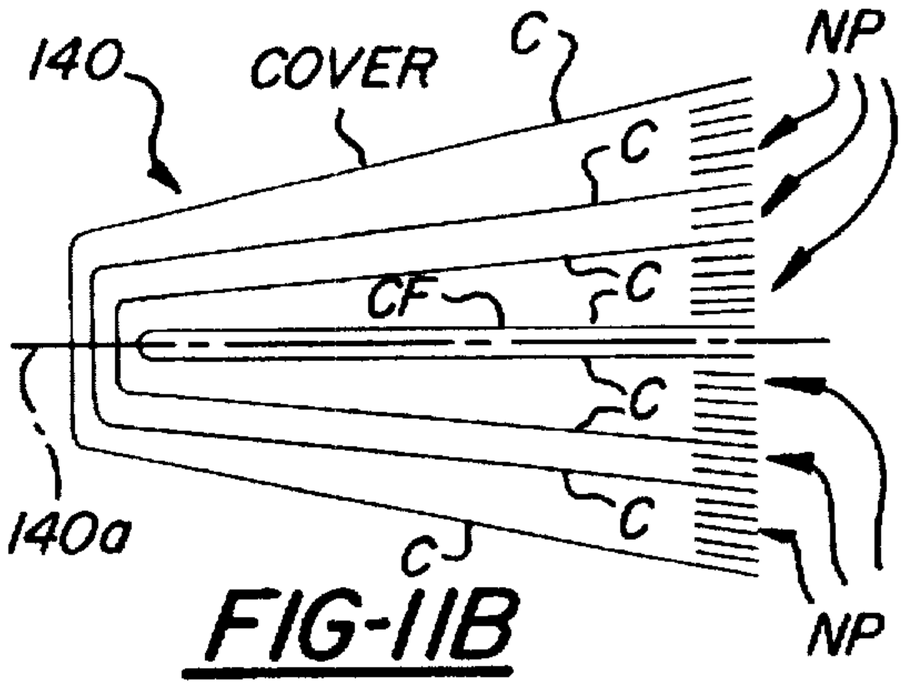


FIG-11B

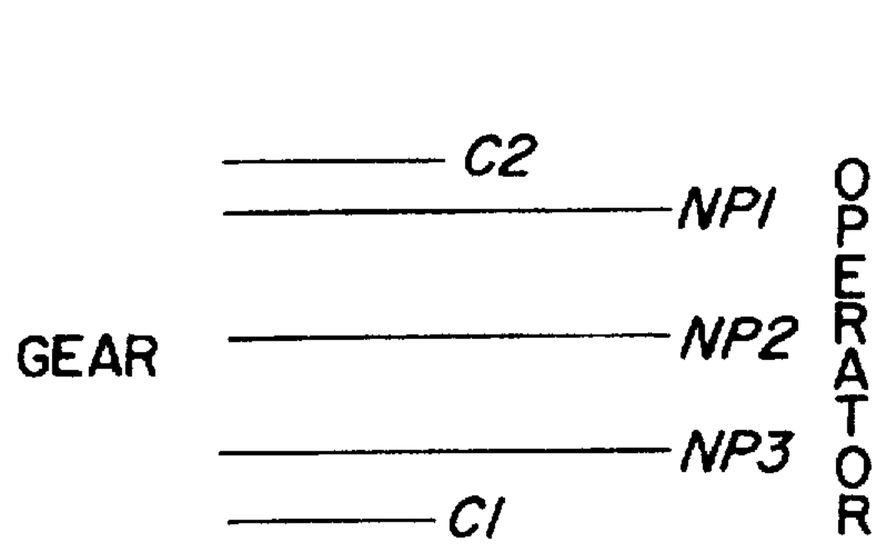


FIG-12A

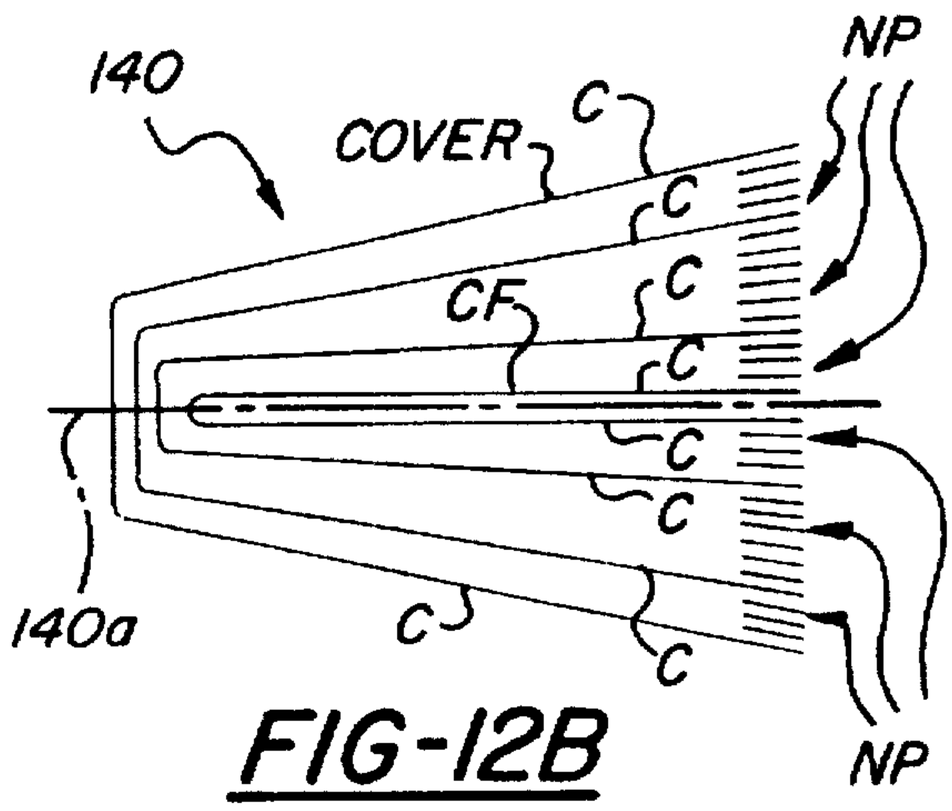


FIG-12B

PRINTING METHOD AND APPARATUS

REFERENCE TO RELATED APPLICATIONS

This is a divisional of application Ser. No. 168,752 filed on Dec. 16, 1993, which is a continuation-in-part of Ser. No. 07/902,840, filed Jun. 23, 1992, now U.S. Pat. No. 5,320,334.

FIELD OF THE INVENTION

This invention relates to printing methods and apparatus and more particularly to the formation of books comprising pages of coated paper interspersed with pages of newsprint paper.

BACKGROUND OF THE INVENTION

There is a need in the printing industry to provide a cost-effective means of providing individual books, each comprising a plurality of pages of coated paper interspersed with a plurality of pages of newsprint paper. Such a book may comprise for example a TV book provided in association with a newspaper. It is desirable in such a book to have several pages of coated paper included in the book to accommodate and attract advertisers desiring glossy, multicolor advertising entries. In the past these books have been provided by separately printing, folding, and cutting one or more coated webs, placing the coated products in inventory, separately printing, folding, and cutting one or more newsprint webs, placing the newsprint products in inventory, and thereafter, at a convenient time and place bringing the coated and newsprint products together in a stapling operation to provide the final book. This separate printing of the coated and newsprint webs, followed by the final stapling of the coated and newsprint products together to form the book, is extremely expensive and time-consuming.

SUMMARY OF THE INVENTION

This invention is directed to the provision of an improved method and apparatus for forming books comprising pages of coated paper interspersed with pages of newsprint paper.

This invention is further directed to the provision of an improved method and apparatus for forming books containing pages of coated paper interspersed with pages of newsprint paper and further providing perforations on the interior coated pages of the book to facilitate the removal of coupons from the book.

This invention is further directed to the provision of an improved method and apparatus for forming books containing pages of coated pages interspersed with pages of newsprint paper and further providing an extreme versatility with respect to the relative positioning of the coated and newsprint pages within the book.

According to the invention methodology, first, second and third moving webs of paper are provided; the first, second and third moving webs of paper are printed at first, second and third printing stations, respectively; a folder is provided; an interleaver is provided; first and second web paths are defined for the first and second moving webs extending from the first and second printing stations respectively, extending through the interleaver along spaced but aligned interleaver path portions, and extending to the folder; a third web path is defined for the third moving web extending from the third printing station to the interleaver; and a plurality of alternate entry path portions are provided for the third web as it enters the interleaver with at least some of the entry path portions providing different interleave relations with respect to the

spaced interleaver path portions of the first and second webs. This arrangement allows the third web to be selectively interspersed between the first and second webs to produce, in combination with the subsequent folding operation, books having a wide variety of interspersed relative relationships as between the paper of the first, second and third webs.

According to a further feature of the invention methodology, the step of providing first, second and third moving webs of paper comprises providing first and second moving webs of newsprint paper and a third moving web of coated enamel paper. This methodology, utilizing the alternate entry path portions, allow the production of books having various interspersed relations of coated and newsprint pages.

According to a further feature of the invention methodology, the third moving web is passed through a heat set station and a chiller station after leaving the third printing station and before entering the interleaver. This arrangement ensures that the ink on the coated enamel paper is thoroughly dried prior to entering the interleaver so as to not create smudging during the interleaver process and the subsequent folding process.

According to a further feature of the invention methodology, the third moving web is passed through a perforating station after leaving the third printing station and before entering the interleaver. This arrangement allows selected printed areas on the coated enamel web to be delineated by perforations so as to provide coupons on selected coated pages in the finished book.

According to a further feature of the invention methodology, the third moving web is slit after it leaves the third printing station and before entering the interleaver to define a plurality of third web portions, and each of the third web portions is delivered to the interleaver along a different entry path portion. This arrangement further amplifiers the possible permutations with respect to the relative positionings of the coated and newsprint paper in the finished book.

According to a further feature of the invention methodology, a fourth moving web of paper is provided comprising a moving web of newsprint paper, the fourth moving web is printed at a fourth printing station, a fourth web path is defined for the fourth web extending from the fourth printing station and extending through the interleaver along an interleaver path spaced from but aligned with the interleaver path portions of the first and second webs, and the step of providing a plurality of entry path portions for the third web as it enters the interleaver comprises providing entry path portions for the third web providing interleaved relations with respect to the fourth web. The provision of a fourth moving web, in combination with the provision of entry path portions for the third web with respect to the fourth moving web, further augments the ability of the invention methodology to provide a wide variety of interspersed relations of coated and newsprint pages in the finished book.

The invention also provides an improved printing apparatus. The improved printing apparatus comprises means defining sources of first, second and third webs of paper; first, second and third printing units for printing the first, second and third webs of paper, respectively; a folder; an interleaver; means defining first and second web paths for the first and second webs extending from the respective web source to the respective first and second printing units, extending through the interleaver along spaced but aligned interleaver path portions, and extending to the folder; means defining a third web path for the third web extending from

the respective web source to third printing unit and thence to the interleaver; and means defining a plurality of alternate entry path portions for the third web as it enters the interleaver with at least some of the entry path portions providing different interleave relations with respect to the spaced interleaver path portions of the first and second webs. This apparatus allows the production of books in which the paper of the first, second and third webs is interspersed within the book in a wide variety of interspersed combinations.

According to a further feature of the invention apparatus, the means defining a source of first, second and third webs of paper comprises means defining sources of first and second webs of newsprint paper and means defining a source of a third web of coated enamel paper. This arrangement allows coated enamel paper to be interspersed in the final book with pages of newsprint paper in a wide variety of combinations as determined by the specific entry path portion chosen for the third web as it enters the interleaver.

According to a further feature of the invention apparatus, the apparatus further includes a heat set station and a chiller station and the third web path extends from the third printing unit to the heat set station and thence to the chiller station and thence to the interleaver. This arrangement allows the printed coated enamel paper to be rapidly dried prior to entering the interleaver so as to avoid smudging during the interleaver operation and during the subsequent folding operation.

According to a further feature of the invention apparatus, the apparatus further includes a perforating station and the third web path extends from the third printing unit to the perforating station and thence to the interleaver. This arrangement allows the third web, prior to entering the interleaver, to be selectively perforated so as to provide coupon areas on the coated web for inclusion in the finished book at a location in the book determined by the particular entry path selected for the third web as it enters the interleaver.

According to a further feature of the invention apparatus, the apparatus further includes a slitter operative to slit the third web into a plurality of third web portions after the third web leaves the third printing unit and before it enters the interleaver, and means operative to deliver each of the third web portions to the interleaver along a different entry path portion. This arrangement further augments the ability of the apparatus to provide a wide variety of relative positionings of the coated and newsprint pages in the finished book.

The invention also provides an improved book. The book according to the invention comprises a plurality of pages of interspersed multi-color coated pages and newsprint pages adhesively bound along one of their common edges wherein each book has a front and rear cover page formed of multi-color coated paper, each book includes pages of coated paper interspersed between the cover pages with pages of newsprint paper, each page is formed as one half of a folded sheet, and the folded sheets are arranged in nested relation with all of the folds arranged on a single common center line passing through the common adhesively bound edge.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a somewhat schematic side elevational view of the invention printing apparatus;

FIGS. **1A** and **1B** are fragmentary views of a coated web of paper moving through the invention printing apparatus;

FIG. **2** is a somewhat schematic plan view of the invention printing apparatus with upper portions of the apparatus omitted for clarity;

FIGS. **3** and **4** are fragmentary views of a folding unit employed in the invention printing apparatus;

FIG. **5** is a perspective view of a book produced in accordance with the method and apparatus of the invention;

FIG. **6** is a perspective view of a chiller employed in the invention printing apparatus;

FIG. **7** is a schematic, perspective view of an interleaver and a perforator employed in the invention printing apparatus;

FIG. **8** is a schematic view looking in the direction of the arrow **8** in FIG. **7**;

FIGS. **9A** and **9B**, **10A** and **10B**, **11A** and **11B**, and **12A** and **12B** are views illustrating various book configurations producible utilizing the invention method and apparatus; and

FIG. **13** is a schematic view illustrating the selective positioning of turn bars utilized in the invention printing apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention printing apparatus, as is customary, includes an operator side, providing operator access to the press, and a gear side, remote from the operator side.

The invention printing apparatus, broadly considered, includes web roll support stands **10**, **12**, **14**, and **16**; a perforating unit **18**; printing units **20** and **22**, a dryer or heatset unit **24**; a folder **26**; a trimmer **28**; and an interleaver **30**.

A web roll C of coated paper is supported on web roll support stand **10**; web rolls NP1, NP2 and NP3 of newsprint paper are supported respectively on web roll support stands **12**, **14** and **16**; and a plurality of guide rollers **40** are provided to define the paths of the various webs as they move through the invention printing apparatus paper.

Web roll C may comprise, for example, a 34 inch wide web of 40 lb. No. 5 coated enamel groundwood paper and newsprint rolls NP1, NP2 and NP3 may comprise 34 inch wide web rolls of 30 lb. groundwood newsprint paper.

Perforating unit **18** includes a housing **18***a*, a perforating roller **18***b*, and a backing roller **18***c*.

Printing unit **20** may comprise a "four-high" including a housing **20***a* and four vertically stacked printing couples **20***b*, **20***c*, **20***d*, and **20***e*. Printing unit **20** is preferably of the offset type.

Printing unit **22** may also be of the "four-high" offset type and includes a housing **22***a* and vertically stacked printing couples **22***b*, **22***c*, **22***d*, and **22***e*.

Heatset unit **24** includes a housing **24***a*, a plurality of sets of opposed nozzles **24***b*, a source of hot air **24***f*, and a chill unit **24***g* including a plurality of chill rolls **24***h*. Heat source **24***f* may include an open gas flame providing heated air and a blower arranged to deliver the heated air to the nozzles **24***b*. Each chill roll **24***h* is hollow and is arranged to have refrigerant passed end to end through the chill roll in a closed loop manner with the refrigerant leaving one end of each chill roll and passing to a refrigeration unit **24***i* where it is cooled for resupply to the other end of the chill roll.

Folder **26** includes a housing and frame structure **50**; a former **52**; a roller-top-of-former **54**; a pressure roller **56**; adhesive nozzles **58**; point-of-former rollers **60**; nipper rollers **62**; a cross-perforating roller **64** coacting with a backing roller **66**; a cutting cylinder **68**; a half-fold jaw cylinder **70**; a rotary brush **72**; a delivery board **74**; a quarter folder **76**; a delivery fly **78**; and delivery belts **80**.

Trimmer **28** is shown only schematically and includes an in-feed conveyor **90**, a right angle transition conveyor **92**, and trimming knives **94**, **96**, and **98**.

Interleaver **30** is positioned, for example, on top of perforator **18** and below chiller **24***g*. The coated web C leaving chiller **24***g* is routed downwardly along the operator side of the press to the perforator **18**, and is thereafter route upwardly into the interleaver for upward movement along the gear side of the press for selective delivery, along a plurality of alternate paths, in interspersed relation with respect to the moving webs NP1, NP2 and NP3 passing through the interleaver.

The path of the newsprint web NP1 through the invention apparatus, broadly considered, extends from the newsprint roll NP1, through a tensioning unit **34**, through printing unit **22**, through interleaver **30**, through folder **26**, and thence to trimmer **28**.

Specifically, newsprint web NP1 extends from the roll around guide rollers **40** into the upper section of printing unit **22** where it passes upwardly through printing couple **22***e* to receive, for example, a black ink, whereafter the web leaves the upper end of the printing unit **22**, passes around a guide roller **40**, and moves forwardly for passage through interleaver **30**, whereafter the web continues forwardly for passage around a guide roller **40**, whereafter the web moves rearwardly for passage through the folder and thence to the trimmer **28**.

The path of newsprint web NP2 extends from roll stand **14**, around suitable rollers **40**, through tension unit **34** and into the printing unit **22** where it passes upwardly through printing couple **22***a* to receive, for example, a black ink whereafter it passes out of the printing unit **22** and upwardly for passage around a further guide roller **40** and thereafter moves forwardly through interleaver **30** in downwardly spaced but aligned relation with respect to newsprint web NP1, whereafter it continues forwardly and around a guide roller **40**, whereafter it moves rearwardly for entry into the folder and passage through the folder to the trimmer **28**.

Newsprint web NP3 extends from roll stand **16** through tensioner **34**, upwardly through the printing couple **23***b* of printing unit **22** where it receives, for example, a black ink, whereafter the web passes upwardly for passage around a further guide roller **40** and thereafter moves forwardly through interleaver **30** in downwardly spaced but aligned relation with respect to newsprint web NP2, whereafter it continues forwardly and around a guide roller **40**, whereafter it moves rearwardly for entry into the folder and passage through the folder to the trimmer.

The path of coated web C through the invention printing apparatus, broadly considered, extends from the coated web roll C through a tensioning unit **32** to printing unit **20**, to the heatset unit **24**, to perforator **18**, to interleaver **30**, to folder **26**, and thence to trimmer **28**.

Specifically, coated web C extends from the coated web roll over a guide roller **40** and enters the tension unit **32**; thereafter passes upwardly out of the tensioning unit and around a guide roller **40** to enter the lower end of printing unit **20** where it passes upwardly through the four printing couples **20***b*, **20***c*, **20***d* and **20***e* to receive four different color impressions from the respective four printing couples; thereafter passes upwardly out of the printing unit and over a guide roller **40** and moves rearwardly through the heatset unit **24** where it is initially exposed to the nozzles **24***b* supplied with hot drying air from the heater unit **24***f* to heat the web and the ink lying on the coated surfaces of the web, whereafter the web passes over the chill rollers **24***h* of chiller **24***g* where it is chilled to set the ink on the coated surface of the web, whereafter the web leaves the lower end of the heat set unit and passes around forward and rearward guide rollers **40**, moves rearwardly for passage around a turn bar **100**, moves laterally outwardly to the operator side of the press for passage over a guide roller **40**, moves downwardly along the operator side of the press, moves around a guide roller **40** and laterally inwardly into perforator **18** to a turn bar **102**, thereafter moves rearwardly for passage around a guide roller **40**, thereafter moves downwardly within the perforator for passage around a further guide roller **40**, thereafter moves forwardly within the perforator for passage around a further guide roller **40**, thereafter moves upwardly for passage through perforator rollers **18***b*, **18***c*, thereafter moves around a further guide roller **40** for forward movement within the perforator to a further guide roller **40**, thereafter moves upwardly within the perforator and moves around a further guide roller **40**, thereafter moves rearwardly within the perforator for passage around a turn bar **104**, and thereafter moves laterally outwardly to the gear side of the press.

At the gear side of the press, the coated web passes around a slitter roller **106**, power driven by a motor **108**, where the web is slit in half by a slitter **106***a* to form coated web halves C1 and C2. The two coated web halves then move upwardly into the interleaver for upward movement along the gear side of the interleaver. As the web halves C1 and C2 move upwardly along the gear side of the interleaver they move selectively around first and second guide rollers, respectively, of a set of vertically spaced guide rollers **110**, **112**, **114**, **116** and **118** and move laterally inwardly along a plurality of alternate interleaver entry path portions to an interleaved relation with respect to one or more of the vertically spaced newsprint webs NP1, NP2 and NP3 passing through the interleaver, whereafter the web halves move around first and second turn bars of a set of vertically spaced turn bars **120**, **122**, **124**, **126** and **128** and move forwardly in interleaved relation to the webs NP1, NP2 and NP3 to one or more guide rollers **130**, **132**, **134**, and **136** from where they move rearwardly for entry into the folder, whereafter, after passing through the folder, they are delivered to the trimmer **28** for suitable trimming operations.

As best seen in FIG. **13**, each turn bar **120**, **122**, **124**, and **126** may be selectively moved in a translatory manner along suitable guide tracks **137** utilizing suitable motor means **138** to selectively vary the registry of each coated web half C1, C2 with respect to the newsprint webs and to selectively determine whether the web half C1, C2 is positioned on the gear side or the operator side of the newsprint webs.

The webs NP1, NP2, NP3, C1 and C2 arrive at the entry to the folder in vertically stacked relation. As the superposed webs approach the top of former roller **54**, each of the newsprint webs passes beneath two laterally spaced spray nozzles **58** which, as best seen in FIG. **3** and FIG. **1B**, act to apply an adhesive or paste along longitudinal lines **58***a* on the respective webs. Page lines **58***a* are each spaced equidistant from the centerline of the web and a respective side edge of the web.

The superimposed webs immediately thereafter pass between the former roller **54** and the pressure roller **56** where the webs are glued together along the glue lines **58***a*, whereafter the webs pass downwardly over the former **52**. As the webs reach the nose **52***a* of the former, a first fold is made in the product along the longitudinal centerline of the webs. The rollers **60** guide the webs over the former nose and help to form the fold whereafter the folded webs travel between the nipping rollers **62** which put a sharp crease in

the first fold. As the webs move downwardly from the triangular edges of the former to the rollers **60**, a further spray nozzle **58** positioned beneath the former **52** between the two sides of the webs serves to apply a further adhesive line **58***b* to one of the inner web surfaces formed as the web is folded around the edges of the former. After the folded web leaves roller **62** it passes through cross-perforating roller **64** and receives a further adhesive line **58***c* from a further spray nozzle **58**, whereafter it passes downwardly between cutting cylinder **68** and half jaw cylinder **70** where a tucker blade on the cutting cylinder coacts in known manner with movable and stationary jaws on the half fold cylinder to tuck or fold the web, whereafter, with further relative rotation of cylinders **68** and **70**, the cylinders coact in known manner to cut the web and form a book **140** which is thereafter, in coaction with fingers carried on the rear edge of the delivery board **74**, passed upwardly between the rear edge of the delivery board and the roller **72** for passage on the board **74** to the quarter folder **76** which rotates in known manner and acts to put a final fold in the book, whereafter the book passes downwardly through an opening in the board **74** for delivery to fly **78** which deposits the book onto belt **80** which delivers the book to the delivery end of the folder. Folder **26** may for example comprise a Rockwell-Goss SSC Folder available from the Graphic Systems Division of Rockwell International of Chicago, Ill.

As the book leaves the delivery end of the folder, it is deposited on conveyor **90** of trimmer **28** and moved past cutter **94** which trims the face of the book, whereafter the book is deposited onto right angle conveyor **92** where it passes between trimmers **96** and **98** which respectively trim the head and foot of the book, whereafter the completed book is deposited in a suitable receptacle. Trimmer **28** may for example comprise a Model AGT 100 Series Trimmer available from AGE Corporation of York, Pa.

The completed book **140** comprises a plurality of pages of interspersed multicolor coated pages and newsprint pages adhesively bound along one of their common edges wherein each book has a front and rear cover page formed of multicolor coated paper, each book includes pages of coated paper interspersed between the cover pages with pages of newsprint paper, each page is formed of one half of a folded sheet, and the folded sheets are arranged in nested relation with all of the folds arranged on a single common centerline **140***a* passing through the common adhesive edge.

The specific interleaved relation of the coated and newsprint pages in the finished book can be selectively varied according to the invention by selective variation of the alternate entry web paths employed for the coated web halves C1 and C2 as they enter between the newsprint webs in the interleaver.

Specifically, after being slit by roller **106**, the coated web halves C1 and C2 may be passed selectively around guide rollers **110**, **112**, **114**, **116**, and **118** to determine the interleaved relation of each coated web half with respect to newsprint webs NP1, NP2, and NP3 and, by selective positioning of the related turn bars **120**, **122**, **124**, **126**, and **128**, each web path may be positioned either on the gear side of the interleaver or the operator side of the interleaver with respect to the associated newsprint web. The particular interleaved relation of the coated and newsprint webs in the finished book is therefore determined by the choice of entry paths for the coated web halves C1 and C2 as they enter the interleaver and also by the positioning of each web half either on the gear side or the operator side with respect to the associated newsprint webs.

FIGS. **9–12** illustrate four of the multitude of possible interleaved relations that are possible, utilizing the invention, in the finished book.

Each of FIGS. **9–12** is divided into an A figure and a B figure with the A figure schematically depicting the relative positioning of the newsprint webs and the coated webs in the interleaver **30** and the B figure depicting the coated and newsprint page configuration in the finished book **140**.

In the example of FIG. **9**, web half C1 is passed around roller **110** and is positioned by turn bar **120** on the gear side of the interleaver beneath newsprint web NP3, and coated web half C2 is passed around guide roller **112** and is positioned by turn bar **122** on the gear side of the interleaver between coated web half C1 and newsprint web NP3. After leaving the interleaver, coated web halves C1 and C2 pass around guide rollers **130** and **134**, respectively, for entry into the folder with the newsprint webs. After passing through the folding and trimming operations, the interleave relation shown in FIG. **9**A produces the finished book configuration shown in FIG. **9B**.

In the book of FIG. **9B**, the two folded outer sheets of the book comprise coated sheets, the two folded centerfold sheets of the book comprise coated sheets, and **16** folded sheets of newsprint paper are positioned between the two outer folded coated sheets and the two inner centerfold coated sheets.

In the example of FIG. **10**, web half C1 is passed around roller **110** and around turn bar **120** to position the web half in underlying relation to newsprint web NP3 on the gear side of the interleaver, and coated web half C2 is passed around roller **116** and around turn bar **126** to position the web half between newsprint web NP1 and newsprint web NP2 on the operator side of the interleaver. In this case, web half C1 passes around guide roller **130** for entry into the folder and web half C2 passes around guide roller **134** for entry into the folder.

The finished book, as seen in FIG. **10B**, comprises an outer folded cover sheet formed of coated paper, four folded newsprint sheets positioned immediately within the folded coated cover sheet, a second folded coated sheet positioned within the four folded newsprint sheets, four more folded newsprint sheets positioned within the second folded coated sheet, a third coated folded sheet positioned within the second set of four folded newsprint sheets, four more folded newsprint sheets positioned within the third folded coated sheet, and a folded centerfold coated sheet.

In the example shown in FIG. **11**, coated web half C1 is passed around roller **112** and is positioned by turn bar **120** beneath newsprint web NP3 on the gear side of the interleaver, and coated web C2 is passed around guide roller **114** and positioned by turn bar **124** between newsprint webs NP2 and NP3 on the operator side of the interleaver. In this case, coated web C1 passes around guide roller **130** for entry into the folder and coated web C2 passes around guide roller **132** for entry into the folder.

The book produced by this interleaved relation, as seen in FIG. **11B**, includes a folded outer sheet of coated paper, five sheets of folded newsprint paper immediately inside of the coated cover sheet, a second folded sheet of coated paper, two folded sheets of newsprint paper within the second coated sheet, a third folded coated sheet, five more folded sheets of newsprint paper within the third folded coated sheet, and a folded coated centerfold sheet.

In the example seen in FIG. **12A**, coated web half C1 is passed around roller **112** and positioned by turn bar **120** beneath newsprint web NP3 on the gear side of the interleaver, and coated web half C2 is passed around guide roller **118** and positioned by turn bar **128** above newsprint web NP1 on the gear side of the interleaver. In this case, web

half C1 moves around guide roller **130** for entry into the folder and coated web half C2 moves around guide roller **136** for entry into the folder.

The finished book, as seen in FIG. **12B**, includes a folded outer coated cover sheet, three folded newsprint sheets positioned within the outer folded cover sheet, a second folded cover sheet, six folded newsprint sheets positioned inside of the second folded coated sheet, a third folded coated sheet, three folded newsprint sheets positioned within the third folded coated sheet, and a folded coated centerfold sheet.

From the examples given it will be seen that a myriad of relative interleave positionings of the coated and newsprint sheets is made possible by the invention methodology and apparatus.

In addition to providing a book comprising a plurality of sheets of multicolor coated paper and a plurality of selectively interleaved sheets of newsprint paper adhesively bound along a common edge, the invention further enables the ready and selective provision of detachable coupons on any or all of the pages of the sheets of coated paper.

For example, with reference to FIGS. **1A** and **5**, and considering the interleave arrangement of FIGS. **9A** and **9B**, the perforating unit **18** may be arranged such that a series of pizza coupons PC are provided on one of the pages of the inner centerfold sheets (CF Inner) and a series of chicken coupons CC are provided on an opposing page of the inner centerfold sheet. As seen in FIG. **1A**, perforating roll **18***b* is configured to perforate the coated web passing thereby in a manner to provide four vertically stacked pizza coupon perforations outlined in an area of the web that will ultimately become one of the pages of the inner center fold sheet (CF Inner) and to provide a series of perforations outlining a plurality of chicken coupons CC on the area of the web that will ultimately become the opposing page of the inner centerfold sheet. Obviously, the perforating cylinder **18***b* may be arranged to provide perforated coupon areas at any of the areas of the coated web passing therebetween, including the areas identified as Cover Inner and Cover Outer, but it would ordinarily not be desirable to provide perforation areas on the area that will become the outer cover to avoid defacing the outer cover upon detachment of the coupons. It will be of course understood that the printing couples **20***b*, **20***c*, **20***d*, and **20***e* are arranged so as to print single color or multicolor coupon indicia within the areas outlined by the perforating roller **18***b* so as to provide the desired color and information within each coupon area outlined by the perforating roller.

The invention will be seen to provide a method and apparatus for producing a booklet of interspersed coated pages and newsprint pages in a cost-effective manner. More specifically, the invention will be seen to provide a method and apparatus for producing a book of interspersed coated and newsprint pages in which the book is produced in a total, continuous on-press run. The invention allows the ready and inexpensive provision of a book having a number of glossy coated pages so as to enhance the attractiveness of the book to advertisers by offering a relatively large quantity of glossy, four-color advertising space in a given size book. The invention method and apparatus further allows the ready provision of detachable coupons on the glossy, four-color advertising pages to further enhance the appeal of the book to advertisers. The invention method and apparatus further allows the relative positioning of the newsprint and coated pages to be readily varied to provide any one of a myriad of relative position combinations depending upon the advertising requirements of the particular book being produced.

Whereas a preferred embodiment of the invention has been illustrated and described in detail, it will be apparent that various changes may be made in the disclosed embodiment without departing from the scope or spirit of the invention.

I claim:

1. A method of forming a plurality of books comprising the steps of:

providing first, second and third moving webs of paper;

printing the first, second and third moving webs of paper at first, second and third printing stations respectively;

providing a folder;

providing an interleaver;

defining first and second web path s for said first and second moving webs extending from the first and second printing stations respectively, extending through the interleaver along spaced but aligned interleaver path portions, and extending to the folder;

defining a third web path for said third moving web extending from said third printing station to said interleaver; and

providing a plurality of alternate entry path portions for said third web as it enters the interleaver with at least some of said entry path portions providing different interleave relations with respect to the spaced interleaver path portions of the first and second webs.

2. A method according to claim **1** wherein:

the step of providing first, second and third moving webs of paper comprises providing first and second moving webs of newsprint paper and a third moving web of coated enamel paper.

3. A method according to claim **2** wherein the method includes the further step of:

passing the third moving web through a heat set station and a chiller station after leaving the third printing station and before entering the interleaver.

4. A method according to claim **1** wherein the method includes the further step of:

passing the third moving web through a perforating station after leaving the third printing station and before entering the interleaver.

5. A method according to claim **4** wherein the method includes the further step of:

passing the third moving web through a heat set station and a chiller station after leaving the third printing station and before entering the perforating station.

6. A method according to claim **1** wherein the method includes the further steps of:

slitting the third moving web after it leaves the third printing station and before entering the interleaver to define a plurality of third web portions; and

delivering each of the third web portions to the interleaver along a different entry path portion.

7. A method according to claim **6** wherein:

the step of providing first, second and third moving webs of paper comprises providing first and second moving webs of newsprint paper and a third moving web of coated enamel paper.

8. A method according to claim **7** wherein the method includes the further step of:

passing the third moving web through a heat set station and a chiller station after leaving the third printing station and before entering the interleaver.

9. A method according to claim **8** wherein the method includes the further step of:

passing the third moving web through a perforating station after leaving the chiller station and before entering the interleaver.

10. A method according to claim **2** wherein:

the method includes the further step of providing a fourth moving web of paper comprising a moving web of newsprint paper, printing the fourth moving web at a fourth printing station, defining a fourth web path for said fourth web extending from the fourth printing station and extending through the interleaver along an interleaver path spaced from but aligned with the interleaver path portions of the first and second webs; and

the step of providing a plurality of alternate entry path portions for said third web as it enters the interleaver comprises providing entry path portions for said third web providing interleave relations with respect to the fourth web interleaver path portion.

11. A printing apparatus comprising:

means defining sources of first, second and third webs of paper;

first, second and third printing units for printing said first, second and third webs of paper respectively;

a folder;

an interleaver;

means defining first and second web paths for said first and second webs extending from the respective web source to the respective first and second printing units, extending through the interleaver along spaced but aligned interleaver path portions, and extending through the folder;

means defining a third web path for said third web extending from the respective web source to said third printing unit and thence to said interleaver; and

means defining a plurality of alternate entry path portions for said third web as it enters the interleaver with at least some of said entry path portions providing different interleave relations with respect to the spaced interleaver path portions of the first and second webs.

12. An apparatus according to claim **11** wherein:

the means defining a source of first, second and third webs of paper comprises means defining sources of first and second webs of newsprint paper and means defining a source of a third web of coated enamel paper.

13. An apparatus according to claim **12** wherein:

the apparatus further includes a heat set station and a chiller station; and

said third web path extends from said third printing unit to said heat set station thence to said chiller station and thence to said interleaver.

14. An apparatus according to claim **11** wherein:

the apparatus further includes a perforating station; and

said third web path extends from the third printing unit to the perforating station and thence to the interleaver.

15. An apparatus according to claim **14** wherein:

the apparatus further includes a heat set station and a chiller station; and

said third web path extends from the third printing unit to the heat set station, thence to the chiller station, thence to the perforating station, and thence to the interleaver.

16. An apparatus according to claim **11** wherein the apparatus further includes:

a slitter operative to slit the third web into a plurality of third web portions after the third web leaves the third printing unit and before it enters the interleaver; and

means operative to deliver each of the third web portions to the interleaver along a different entry path portion.

17. An apparatus according to claim **16** wherein:

the means defining a source of first, second and third webs of paper comprises means defining sources of first and second webs of newsprint paper and means defining a source of a third web of coated enamel paper.

18. An apparatus according to claim **17** wherein:

the apparatus further includes a heat set station and a chiller station; and

said third web path extends from said third printing unit to said heat set station, thence to said chiller station, and thence to said interleaver.

19. An apparatus according to claim **18** wherein:

the apparatus further includes a perforating station; and

said third web path extends from the third printing unit to the perforating station and thence to the interleaver.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,749,567

DATED : May 12, 1998

INVENTOR(S) : DeAngelis

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 5, line 7, change "route" to -- routed--.

Signed and Sealed this

Ninth Day of February, 1999

Attest:

Attesting Officer

Acting Commissioner of Patents and Trademarks